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to stand long enough to form a mat of aluminum hydrate over the sand surface before the filter was again put in operation.

The average amount of alum used by this procedure was 40 pounds per day, a saving of an average of 760 pounds per day over the old method. The saving in money for alum and wash water averaged \$7,000 per year.

STUDIES IN THE TREATMENT OF MALARIA.

ABSTRACTS OF THE STUDIES WHICH WERE MADE AT THE REQUEST OF THE BRITISH WAR OFFICE.

By BRUCE MAYNE, Biologist, and MILDRED M. MOSS, Microscopist, United States Public Health Service.

These studies were presented in the papers published in the *Annals of Tropical Medicine and Parasitology*, June 30, 1917, to March 12, 1919. The patients treated were adult males, infected in Macedonia and East Africa 6 to 12 months previously, and all had more or less quinine during that period. Most of them showed clinical symptoms, though a few were treated during an apyrexial period. All showed parasites on the day of beginning treatment or a few days previously. Parasite examinations were made frequently, often daily, during and after treatment. By relapse is meant parasitic relapse. Febrile relapses occurred in all cases of relapse, sometimes a few days later than the first appearance of parasites in the blood.

In estimating the percentage of relapses an arbitrary observation period of 60 days following cessation of treatment was chosen. Whenever it was not possible to follow cases for this period, two percentages are given, the minimum representing the number of relapses actually observed, the maximum including those cases which were not observed for the full 60-day period and which must be counted as possible relapses.

Conclusions Drawn on the Treatment of Malaria.

QUININE.

1. Oral administration of quinine sulphate in doses of 10 grains on each of 2 consecutive days causes only temporary cessation of clinical symptoms and disappearance of parasites from peripheral blood in simple tertian malaria, but has no curative effect. If the doses given on each of the two days do not exceed 30 grains, relapses occur within two or three weeks. A curative effect is manifest when the dose given on each of the two days reaches 45 grains and becomes more marked as it is increased to 90 grains. The dose of 90 grains prevents 62 per cent of cases relapsing (53-165 days' observation).

2. Of the various forms of continuous treatment used, that of 45 grains daily for from three to eight weeks is the best, resulting in 36.8–52.6 per cent of relapses, as compared with a minimum of 60–80 per cent of relapses in cases treated with smaller doses (20–30 grains).

3. Of the various forms of interrupted treatment, that of 45 grains of quinine sulphate on two consecutive days weekly, from four to eight weeks, is the best, resulting in 28.6–38.1 per cent of relapses, as compared with a minimum of 41.2 per cent in cases treated with smaller doses.

4. *Comparison of 2 and 3.*—In both 30 and 45 grain doses the palliative results of the interrupted treatment are better than those of the corresponding continuous treatment. (NOTE.—The number of cases under observation was not the same.) Also, 45 grains twice weekly is better than 30 grains twice weekly or than 30 grains daily, both as a palliative and as a curative treatment.

5. Quinine sulphate orally in doses of 120 grains on each of two consecutive days represents the maximum amount of the drug that can be tolerated by the average case.

6. Of 405 cases treated (simple tertian) 43 per cent relapsed during the first 15 days after cessation of treatment, 19.5 per cent during the second 15 day period, 3 per cent during the third, and 1 per cent during the fourth. If a case of simple tertian malaria has not relapsed parasitically within four weeks after cessation of treatment his risk of relapse is only 13 per cent, whereas if he has not relapsed within six weeks his risk of subsequent relapse is reduced to less than 5 per cent.

7. In two series treated with 90 grains of quinine sulphate on each of two consecutive days only, the curative results were 57 to 62 per cent of cures in Series I (76 cases), and 3 to 6 per cent of cures in Series II (89 cases). The quinine solution was identical. Taking into consideration cases from Saloniki only, thus eliminating the strain of parasites as a factor, 65 per cent of Series I were cured and only 3 per cent of Series II. The length of time between first reporting sick and treatment and between arrival in England and treatment were eliminated as factors. In Series I, patients were treated during the period July–September, 1917. In Series II, patients were treated during the period January–April, 1918. After a study of meteorological observations it was seen that the higher the mean daily temperature, the higher the percentage of cures. The conclusion was reached that the season of the year affected the treatment of malaria.

8. *Second comparison of continued and interrupted treatments.*—Given a total weekly dose of quinine as a palliative, it is better to divide it into two equal parts and administer it on each of two consecutive days than to divide it into six equal parts and administer it

on each of six consecutive days. As a palliative, interrupted treatment is preferable to continuous treatment in simple tertian malaria.

9. Under quinine treatment of 30 or 45 grains daily, crescents do not persist in the cutaneous blood in the majority of cases for more than three weeks.

10. An intramuscular injection of 15 grains of quinine bihydrochloride on each of two consecutive days only, exerts in the case of *P. vivax* a constant and rapid effect on both temperature and parasites; in the case of *P. falciparum* the action on temperature and trophozoites is also well defined, though relapses occur more quickly than in the case of *P. vivax*; whereas in the two cases of *P. malariae* treated in the same way there is little if any effect on the parasites, but in one of the two cases the temperature was controlled.

11. At what time after cessation of treatment (quinine) do relapses occur in simple tertian malaria? Eight hundred cases (including cases cited in No. 6) were treated with varying doses of quinine. The time incidence of relapses were tabulated in three ways:

(a) With reference to the relapses themselves, i. e., the percentage of the total relapses which occur during each period of time. The percentages were as follows: 83.2 per cent during the first 20-day period; 13.74 per cent during the second 20-day period; 2.58 per cent during the third 20-day period; 0.17 per cent during the fourth 20-day period; none during the fifth; 0.17 per cent during the sixth; and 0.17 per cent during the seventh.

(b) With reference to the total cases treated, i. e., the percentage of the total cases treated which relapsed during each 20-day period. These were as follows: 60.6 per cent relapsed during the first 20-day period; 10.2 per cent during the second; 2 per cent during the third; 0.2 per cent during the fourth; and none during the fifth.

(c) With reference to remainders, i. e., the incidence among cases treated, less those which had previously relapsed. These were as follows: 60.6 per cent during the first 20-day period; 26.4 per cent during the second; 7.5 per cent during the third; 1.1 per cent during the fourth; and none during the fifth.

REMEDIES FOR MALARIA OTHER THAN QUININE.

Intravenous injections of tartar emetic do not cause the disappearance of any stage of malaria parasites from the peripheral blood, either in cases of *P. vivax* or *P. falciparum*. These injections do not control either the rigors or the fever of acute malaria.

Intramuscular injections of amylopsin and trypsin proved to be of no value in the treatment of 10 cases of acute simple tertian malaria.

Single intravenous injections of novarsenobenzol-billon, in doses varying from 0.45 to 0.9 gram, control the febrile paroxysms and

cause the disappearance of parasites from the cutaneous blood, as a rule, within 1 day in simple tertian malaria. Parasitic relapses occur on an average in 21 days. The curative effect in the doses used is practically nil.

Quinotoxin hydrochloride in the doses used, 5 and 10 grains, on each of two consecutive days, has practically no action on the parasites or on the fever, and so is inferior in its action to similar doses of quinine sulphate in simple tertian malaria.

A single intravenous injection of 0.2 gram of disodo-luargol caused a temporary disappearance of parasites from the cutaneous blood and controlled symptoms in simple tertian malaria. A relapse occurred within three weeks. Smaller doses were ineffective.

Collosol manganese in the dose used is of no value in the treatment of simple tertian malaria.

Small doses of arsenic in combination with quinine are not more efficacious as a palliative than the small dose of quinine alone.

Liquor arsenicalis in large doses (30 minims daily for eight weeks) controls febrile relapses, but has less control over parasites. The combination of quinine and arsenic in large doses is superior to arsenic alone. As a curative, large doses of arsenic with quinine gave 12.5 per cent of relapses.

Novarsenobenzol-billon in the doses used (0.45–0.9 gram) is of no value in the treatment of malignant tertian malaria. A combination of arsenic with quinine in the doses used (30 grains quinine and 0.9 gram novarsenobenzol-billon) is not more effective than quinine alone.

The action of novarsenobenzol-billon on *P. vivax* is marked. In this infection its action is even more rapid and efficient than that of quinine, a single intravenous injection causing the disappearance from the cutaneous blood of all stages of the parasites within 24 hours. In the case of *P. falciparum* and *P. malarix*, novarsenobenzol-billon in the same dosage has no appreciable effect on temperature or on parasites.

A combination of novarsenobenzol-billon and quinine is more effective in simple tertian malaria than either novarsenobenzol-billon or quinine alone.

The accompanying tables summarize the data presented in these papers:

TABLE I.

Type and number of cases.	Substance and dose.	Length of treatment.	Method of administration.	Toxic effect.	Palliative effect.	Curative effect and relapses.
Simple tertian—20 cases.	Bihydrochloride, 15 grains in 2 c. c. of water daily.	On 2 consecutive days.	Intramuscularly.	Slight pain and tenderness.	Cessation of febrile paroxysms within 2 days; disappearance of parasites from peripheral blood.	95 per cent of cases relapsed in 10-18 days.
Simple tertian—8 cases.	Bihydrochloride, 15 grains.	1 day.	Intravenously.	Of 127 injections, thromboses occurred in 4 patients, 2 in each arm and 2 in one only; no other noticeable symptoms.	Temperature to normal in 1-3 days; disappearance of parasites in 2-5 days.	66 to 100 per cent of relapses in 8-14 days.
Simple tertian—13 cases.	Bihydrochloride, 10 grains, 6 injections in 12 cases; 10 grains, 5 injections in 1 case.	10-12 days.	do.		Temperature to normal after 1-3 injections; disappearance of parasites after 1-4 injections.	93 per cent of relapse in 8-18 days.
Malignant tertian—7 cases.	Bihydrochloride, 15 grains, 1 injection in 2 cases; 10 grains, 4-6 injections in 5 cases.	1-13 days.	do.		Temperature controlled for few days; parasites not eradicated.	No curative effect.
Simple tertian—38 cases.	Quinine alkaloid, 15-30 grains, 1 or 2 injections.	1-2 days.	Intramuscularly.	Subcutaneous injections resulted in stinging, some pain and slight swelling.	Cessation of febrile paroxysms and disappearance of parasites in 1-2 days.	82 per cent of relapses in 60 days.
Simple tertian—12 cases.	Sulphate, 5 grains daily.	2 days.	Orally.		In 10 cases fever subsided in 1-3 days; 1 case in 8 days; 1 case no effect.	93 per cent of relapses in 60 days.
Simple tertian—18 cases.	Bihydrochloride, 5 grains daily.	On 2 consecutive days.	do.		Temperature to normal in 1-4 days; parasites disappeared in 1-3 days in 17 cases.	100 per cent relapse in 3-15 days.
Simple tertian—10 cases.	Sulphate, 10 grains daily.	do.	do.		Temperature to normal in 1-2 days; parasites disappeared in 2-3 days.	100 per cent relapses in 10-18 days.
Simple tertian—14 cases.	Sulphate, 15 grains daily.	do.	do.		Temperature to normal in 1-2 days; parasites disappeared in 1-5 days.	100 per cent relapses in 8-22 days.
Do.	Sulphate, 30 grains daily.	do.	do.		Temperature to normal in 1-6 days; parasites disappeared in 1-4 days.	100 per cent relapses in 7-20 days.
Simple tertian—12 cases.	Sulphate, 45 grains daily.	do.	do.		Temperature to normal in 1-3 days; parasites disappeared in 1-3 days.	83 per cent relapses in 13-25 days.
Do.	Sulphate, 60 grains daily.	do.	do.		Temperature to normal in 1-2 days; parasites disappeared in 1-3 days.	58 per cent relapses in 11-27 days.
Simple tertian—76 cases.	Sulphate, 90 grains daily.	do.	Orally and intramuscularly.	Deafness and dimness of vision, vomiting, and giddiness for 2-3 days.	do.	39 per cent relapses in 14-37 days.
Simple tertian—5 cases.	Sulphate, 20 grains daily.	14-15 weeks.	Orally.		Temperature to normal in 1 day; parasites disappeared in 4 cases in 1-3 days; present at intervals in 1 case.	60-80 per cent relapses in 3-33 days.
Simple tertian—14 cases.	Sulphate, 30 grains daily.	5-18 weeks.	do.		Temperature to normal in 1-2 days; parasites disappeared in 2-5 days.	71 per cent relapses in 3-46 days.

Simple tertian— 29 cases. Simple tertian— 19 cases.	.....do..... Sulphate, 45 grains daily.....	8 weeks..... 3-8 weeks.....	.....do..... .....do.....	Only 7 of 19 cases able to complete 8 weeks' treatment.	Temperature to normal in 1-5 days; parasites disappeared in 1-3 days; Temperature to normal in 1-2 days; parasites disappeared in 1-3 days.	83 per cent relapses in 6-38 days. 37 per cent relapses in 4-37 days.
Simple tertian— 18 cases. Simple tertian— 64 cases. Simple tertian— 203 cases. Simple tertian— 29 cases. Simple tertian— 15 cases.	Sulphate, 10 grains on 2 consecutive days weekly. Sulphate, 15 grains on 2 consecutive days weekly. Sulphate, 30 grains on 2 consecutive days weekly. Sulphate, 45 grains on 2 consecutive days weekly. Sulphate, 120 grains on 2 consecutive days.	8-10 weeks..... 2-11 weeks..... 2-12 weeks..... 4-8 weeks..... 2 days.....	.....do..... .....do..... .....do..... .....do..... .....do.....	.....do..... .....do..... Only 10 cases able to complete treatment; deafness, bluishness, collapse, not lasting more than 1 week.	.....do..... .....do..... Temperature to normal in 1-5 days; parasites disappeared in 1-3 days; Temperature to normal in 1-3 days; parasites disappeared in 1-4 days; Temperature to normal in 1-4 days; parasites disappeared in 12-24 days.	39-55 per cent relapses in 1-15 days. No observations. Do. 21-55 per cent relapses in 5-18 days. 60 per cent relapses in 12-34 days.
Simple tertian— 24 cases.	Sulphate, 90 grains daily.....	On 2 consecu- tive days weekly 3 weeks.	.....do.....	.....do.....	Temperature to normal in 1-2 days; parasites disappeared in 1-3 days.	46-50 per cent relapses in 3-57 days.
Simple tertian— 89 cases. Simple tertian— 30 cases. Simple tertian— 47 cases.	.....do..... Bihydrochloride, 30 grains intramuscu- larly; 30 grains orally. Sulphate, 5 grains daily 6 days in week.	On 2 consecu- tive days weekly 12 days..... 8 weeks.....	.....do..... .....do..... Orally.....	Quinine poisoning, 2- 3 days.	Temperature to normal in 1-3 days; parasites disappeared in 1-5 days; Temperature to normal in 1 day; para- sites disappeared in 1-4 days. Temperature uncontrolled in 3 cases; Temperature to normal in 1-5 days; in others; parasites disappeared in 1-5 days in 34 cases.	94 per cent relapses in 12-53 days. 87 per cent relapses in 8-6 days. 81-83 per cent relapses in 60 days.
Simple tertian— 65 cases. Simple tertian— 49 cases. Simple tertian— 74 cases. Simple tertian— 30 cases. Malignant ter- tian—29 cases.	Sulphate, 15 grains on each of 2 consecu- tive days weekly. Sulphate, 15 grains daily 6 days in week. Sulphate, 45 grains on each of 2 consecu- tive days weekly. Bihydrochloride, 15 grains daily.....	.....do..... .....do..... .....do..... 2 days..... .....do.....	.....do..... .....do..... .....do..... Intramuscularly.....do.....	.....do..... .....do..... .....do..... .....do.....	Temperature to normal in 1-5 days; parasites disappeared in 1-4 days. Temperature to normal in 4 days; parasites disappeared in 1-3 days; Temperature to normal in 4 days; para- sites disappeared 1-4 days. Temperature to normal in 3 days; para- sites disappeared 1-4 days. Temperature to normal in 3 days; rings disappeared in 4 days, cres- cents usually persisted.	79-84 per cent of cases relapsed in 60 days. 64-66 per cent cases relapsed in 1-56 days. 80-85 per cent relapses in 1-47 days. 70 per cent relapses in 100-255 days. 100 per cent relapses in 3-21 days.
Malignant ter- tian—18 cases. Simple tertian— 10 cases.	Sulphate, 30 grains on each of 2 con- secutive days weekly. Tartar emetic, 2.2-10.1 grains (total), 2-6 injections.	5 weeks..... 13-14 days.....	Orally..... Intravenously.....	Coughing and vomit- ing and in 1 case col- lapse.	Temperature to normal in 1-3 days; rings disappeared in 1-4 days. Did not control fever or eradicate para- sites.	Not observed. No effect.
Simple tertian— 1 case. Malignant ter- tian—10 cases.	Quinine, 20 grains daily, 10 days..... Tartar emetic, 2.2 grains (total) in 3 injections. Tartar emetic, 4.5-11.2 grains (total), 3-6 injections.	9 days..... .....do..... 5-12 days.....	Orally..... Intravenously..... .....do.....	Coughing and vomit- ing in several cases.	Fever controlled; parasites disap- peared from peripheral blood. No effect.....	100 per cent relapses in 14 days. No effect.

TABLE 1—Continued.

Type and number of cases.	Substance and dose.	Length of treatment.	Method of administration.	Toxic effect.	Palliative effect.	Curative effect and relapses.
Double injection with sim- ple and malignant tertian—1 case.	Tartaremedic, 4.5 grains (total).	12 days.	Intravenously.		No effect.	No effect.
Simple tertian—20 cases.	Contents of 1 ampoule of trypsin and 1 ampoule of saline, 1-3 injections.	1-7 days.	Into muscle below the scapula.	Some swelling and tenderness.	Fever controlled in 3 cases only; parasites persisted.	Do.
Simple tertian—23 cases.	Novarsenbenzol-billon, 0.45 gram, 1 injection.	1 day.	Intravenously.		Temperature to normal in 1-3 days; parasites disappeared in 1-2 days.	90 per cent relapses in 11-105 days.
Simple tertian—21 cases.	Novarsenbenzol-billon, 0.6 gram, 1 injection.	do.	do.		Temperature to normal in 1-2 days; parasites disappeared 1-2 days.	6 per cent relapses in 10-46 days.
Simple tertian—9 cases.	Novarsenbenzol-billon, 0.9 gram.	do.	do.		do.	95 per cent relapses in 5-63 days.
Simple tertian—9 cases.	Quintoxin, 5 grains, 5 cases, 10 grains daily, 4 cases.	2 days.	Orally.		No effect.	No effect.
Simple tertian—4 cases.	Disodo-tarcol, 0.1 gram on first day, 0.15 gram on fifth day.	5 days.	Intravenously.		None.	None.
Simple tertian—9 cases.	Disodo-tarcol, 0.2 gram.	1 day.	do.		Temperature to normal in 2 days; parasites disappeared in 1-3 days.	100 per cent relapses in 7-17 days.
Simple tertian—13 cases.	Colossal manganese, 1 c. c. on each of 2 consecutive days.	2 days.	Intramuscularly.		None.	None.
Simple tertian—3 cases.	Liquor arsenicals, 15 minims daily.	2 cases, 7 days; 1 case, 22 days.	Orally.		do.	Do.
Simple tertian—2 cases.	{Bihydrochloride, 15 grains on each of first 2 days.	{13-18 days.	{Intramuscularly	{	{Symptoms controlled by quinine, no effect by arsenic.	{ Do.
Simple tertian—28 cases.	Liquor arsenicals, 15 minims daily. Quinine hydrochloride, 5 grains daily.	8 weeks.	{Orally.	{	Temperature to normal in 5 days; parasites disappeared in 1-7 days in 21 cases.	82-86 per cent relapses in 1-37 days.
Simple tertian—25 cases.	Liquor arsenicals, 15 minims; liquor tryphine, 15 minims; quinine hydrochloride, 5 grains daily.	do.	do.		Temperature to normal in 8 days; parasites disappeared in 1-7 days in 21 cases.	75-85 per cent relapses in 1-26 days.
Simple tertian—26 cases.	Quinine hydrochloride, 5 grains daily.	do.	do.		Temperature to normal in 3 days; in 16 cases, parasites disappeared in 1-10 days.	62-69 per cent relapses in 60 days.
Simple tertian—14 cases.	Liquor arsenicals, 30 minims daily.	do.	do.		Temperature to normal in 10 days; in 13 cases parasites disappeared in 2-6 days.	85 per cent relapses in 1-42 days.
Simple tertian—33 cases.	{Liquor arsenicals, 30 minims daily.	{18 weeks—2 weeks on 1 week off.	{do.	{	{Temperature to normal in 2 days; parasites disappeared in 1-4 days.	{12.5 per cent of cases relapsed in 1-15 days.

Malignant tertian—14 cases.	Novarsenobenzol-billon, 0.45-0.9 gram.	1 day	Intravenously	None	None	None.
Malignant tertian—10 cases.	Bihydrochloride, 15 grains on each of 2 consecutive days.	2 days	Intramuscularly	{	{	100 per cent relapses in 6-17 days.
Malignant tertian—1 case.	Bihydrochloride, 15 grains on each of 2 consecutive days.	15 days	Intramuscularly	{	{	100 per cent relapses in 14 days.
Malignant tertian—16 cases.	Liquor arsenicalis, 30 minims daily.	18 days	Orally	{	{	100 per cent relapses 1-38 days.
Simple tertian—22 cases.	Bihydrochloride, 15 grains on first, second, eighth, ninth, fifteenth, and sixteenth days.	4 weeks	Intramuscularly	{	{	77-82 per cent relapses in 1-38 days.
Quartan—2 cases.	Quinine sulphate, 30 grains daily for 3 weeks and 45 grains daily for 1 week.	2 days	Orally	{	{	No effect.
Do	Novarsenobenzol-billon, 0.9 grams, 2 injections.	do	Intravenously	{	{	Do.
Simple tertian—41 cases.	Quinine bihydrochloride, 15 grains, 2 injections.	do	Intramuscularly	{	{	32 per cent relapses in 13-48 days.
Simple tertian—12 cases.	Novarsenobenzol-billon, 0.9 gram, 1 injection.	do	Intravenously	{	{	8-17 per cent relapses in 68 days.
Simple tertian—18 cases.	Bihydrochloride, 15 grains, 2 injections.	16 days	Intramuscularly	{	{	78-83 per cent relapses in 60 days.
Simple tertian—45 cases.	Bihydrochloride, 15 grains, 2 injections.	2 days	Intramuscularly	{	{	20-66.6 per cent relapses in 60 days.
	Liquor arsenicalis, 30 minims daily.	15 days	Orally	{	{	
	Quinine hydrochloride, 15 grain, 6 injections.		Intramuscularly	{	{	

The following is a review of four short papers which were contributed subsequently and which afford a comparative study in the response to treatment of Europeans and natives of tropical countries:

I. Oral Administration of Quinine or Quinine and Arsenic for Short Periods to Young Native Children Infected with Malignant Tertian Malaria. By J. W. S. Macfie and M. W. Fraser.

II. Oral Administration of Quinine Sulphate, Grains 20, to Adult Natives Infected with Malignant Tertian Malaria. By J. W. S. Macfie.

III. Oral Administration of Quinine Sulphate, Grains 10, Daily for Two Consecutive Days Only to Native Schoolboys Infected with Malignant Tertian Malaria. By J. W. S. Macfie.

IV. Oral Administration of Quinine Sulphate to Natives Infected with Quartan and Simple Tertian Malaria. By J. W. S. Macfie.

These observations, recorded in a series of four papers published in the *Annals of Tropical Medicine and Parasitology* for June 30, 1920, were conducted at Accra, in Gold Coast, West Africa, all of the patients being natives infected in Gold Coast, and the periods of observation extending from July to December, 1919. In all cases the presence of trophozoites in the cutaneous blood was determined microscopically on the day that treatment began, although the patients, with few exceptions, appeared to be healthy. The period of observation after treatment, except in Series II of the table (50 days), was 60 days. Treatment was given on two consecutive days (in a few cases on one day only), 20 grains of quinine sulphate in the case of adults, 10 grains (in a few instances, 20 grains) in the case of children. The administration of arsenic in addition to quinine, as tried in the first experiment, did not cause the resulting percentage of relapses to vary from that following the administration of quinine alone. By relapse is indicated parasitic relapse, since very few of the patients gave history of febrile relapse.

In the following table the subjects of the experiments in the three papers dealing with malignant tertian are grouped according to age. Under the percentage of relapses a double percentage is given in some cases, indicating that some of the patients passed from observation before the usual period of 60 days had elapsed, and while no relapse had occurred up to that time they are included in the maximum percentages of relapses possible.

TABLE II.

Series.	Number of patients treated.	Age.	Per cent of relapses.
I.....	17	6 months to 7 years.....	94
II.....	19	5 to 8 years.....	63
III.....	13	9 to 11 years.....	54-69
IV.....	19	12 to 14 years.....	89
V.....	11	15 to 18 years.....	64
VI.....	11	Adults.....	0-9

The author accounts for the fact that the rate of parasitic relapse diminishes with increasing age by development of tolerance in the natives. He concludes that "the power of the natives to cope with malaria infections begins to make itself felt early in life, has already attained a considerable degree of efficiency by the age of 5 to 8 years, thereafter is maintained during adolescence with a remission at the age of puberty, and is enhanced in adult life." In comparing these results with experiments conducted with adult Europeans at Liverpool, he notes that the percentage of relapses among Europeans exceeded even that of native children at Accra, owing, perhaps, to the failure of Europeans to develop tolerance or to the natural differences found in the disease in tropical and temperate climates.

The fourth paper deals with a similar treatment of 20 cases of quartan and simple tertian malaria and tends to confirm the conclusion drawn in the three other papers that in these types, as in malignant tertian malaria, the percentage of relapses in native adults is less than that in young children and in other than very young children is decidedly less in natives of the Tropics than in Europeans treated in England.

VENEREAL DISEASE INCIDENCE AT DIFFERENT AGES.¹

A Tabulation of 8,413 Case Reports in Indiana.

By MARY L. KING and EDGAR SYDENSTRICKER, Statistician, United States Public Health Service.

In a preceding publication² emphasis was placed upon the need for statistical data relating to the incidence and prevalence of venereal diseases. It was pointed out that such data, when properly analyzed, would assist in defining more clearly the particular problems involved at this stage of the antivenereal disease campaign and might afford some guidance in determining the directions in which pre-

¹ From the Statistical Office, United States Public Health Service. Prepared in cooperation with the Division of Venereal Diseases, United States Public Health Service. Acknowledgments are made to the State Board of Health of Indiana for the use of the case reports.

² Pierce, C. C., and Sydenstricker, Edgar. Some Possibilities in the Statistical Analysis of Case Reports of Venereal Diseases: Public Health Reports, Aug. 27, 1920. (35: 2046-2055.)